

## Summary of the Terminal Evaluation

I. Outline of the Project		
Country: Mongolia		Project: Development of Human Capacity for Weather Forecasting and Data Analysis
Sector: Natural environment		Cooperation scheme: Technical cooperation (turnkey contract)
Division in charge: Disaster Management Division 1, Water Resources and Disaster Management Group, Global Environment Department		Cooperation amount (at the time of evaluation): 501,275,000 yen
Period of cooperation	Feb. 2005 to Oct. 2008	Partner country's implementing organizations: National Agency for Meteorology, Hydrology and Environment Monitoring, Ministry of Nature and Environment
		Supporting organizations in Japan: Japan Meteorological Agency, Japan Weather Association
1. Background to and outline of the cooperation		
<p>Mongolia's key industries are agriculture and livestock farming, which account for about 20% of the GDP and employ about 42% of the total working population. In this situation, the recent large-scale droughts and <i>zud</i> (snow disasters) caused serious damage to Mongolia's society and economy. In 2001 and 2002, about 2.69 million domestic animals died, resulting in total damage amounting to 1,008 billion tugrik (about 96 billion yen). The annual damage since 1999 has totaled about 2.31 million domestic animals amounting to about 316.8 billion tugrik in losses (about 30.2 billion yen). Weather disasters, not only from droughts and <i>zud</i>, but also from flooding, hailstone disasters, and strong winds, have occurred throughout the country and have become a factor hindering the social and economic development of Mongolia, which depends on agriculture and livestock farming. In addition, there is concern that not only short-term weather changes, but also climate change due to global warming and long-term changes in the natural environment and terrestrial ecosystems due to desertification and other forms of climate change may have a serious impact on the life of the Mongolian people, who greatly depend on nature, through the impact of weather conditions on agriculture and livestock farming and on water resources.</p> <p>To cope with these problems through the National Agency for Meteorology, Hydrology and Environment Monitoring (NAMHEM), which is the national meteorological agency, the Mongolian Government has carried out activities to improve the meteorological service according to a master plan drawn up with the support of the Japanese experts. Japan has so far dispatched experts including those for the support of establishing the master plan four times and twice given grant aid for the installation of observation, forecasting and network equipment. Concretely, the introduction of equipment for weather observation, forecasting and communication, such as weather radar and an automatic weather observation system, resulted in the establishment of the required physical facilities to some extent. As for the non-physical facilities, JICA's unique training activities, such as the overseas dispatch of engineers, resulted in a certain level of achievement in raising technical skills and improving the weather information system. However, the technical level of NAMHEM as a whole could not be raised</p>		

through the acquisition of the excellent skills of other countries in such fields as numerical forecasting and meteorological analysis, which has become a substantial factor hindering the development of the meteorological sector. In addition, weather information has not been used appropriately due to a lack of understanding on the part of the users, such as administrative agencies and livestock farmers, with the result that disaster prevention activities have not been carried out appropriately.

In response to this situation, the Mongolian Government requested Japan to carry out a technical cooperation project for improving the weather forecasting and warning system through the introduction of new weather analysis and forecasting technologies such as numerical forecasting, preparing predictive information on weather changes in the Mongolian region due to global warming, creating an early warning system for droughts and *zud* (snow disasters), preparing information on the observation of the yellow sand phenomenon and increasing the understanding of administrative agencies and livestock farmers concerning weather information through the development of technical human resources engaged in the meteorological service in order to further expand the foundations of the weather observation service cultivated through the dispatch of experts and the provision of grant aid, aiming to contribute to the appropriate management for natural disasters and the assessing the impact of climate change. As a result, the “Project for the Development of Human Capacity for Weather Forecasting and Data Analysis in Mongolia” has been carried out since February 2005. The mid-term evaluation of this Project was carried out in September 2006, and this Project is scheduled to end in October 2008.

#### Contents of the cooperation

##### (1) Overall goal

Weather information will be used for the management of natural disasters and the impact assessment of climate change.

##### (2) Project goal

More reliable and useful weather information (including information on the yellow sand phenomenon) will be provided in a timely manner through the development of the capacity of meteorological service officials and environmental experts.

##### (3) Outputs

- 1) Realization of numerical forecasting through the use of a regional model for Mongolia
- 2) Prediction of climate change in the Mongolian region due to global warming through the use of a climate model
- 3) Preparation of weather forecasts (short-term, medium-term, long-term) based on numerical forecasting data
- 4) Creation of an early warning system for droughts and *zud*
- 5) Increase in the understanding of weather information on the part of the national and local governments, related organizations and end users (including livestock farmers and residents).
- 6) Stable management of the weather observing and forecasting system (weather radars and computer networks)

<p>7) Preparation of the observation information on the yellow sand phenomenon</p> <p>(4) Inputs (at the time of evaluation): Total amount of inputs: 501,275,000 yen</p> <p>Japanese side (JICA): Dispatch of 14 experts; provision of equipment totaling about 236,125,000 yen; acceptance of 11 training participants; payment of local costs totaling about 19,719,000 yen</p> <p>Mongolian side: Placement of 7 counterparts; provision of land and facilities: offices for the experts; payment of local costs totaling 235.1 million tugrik</p>		
<b>II. Outline of the evaluation team</b>		
Team members	<p>(1) Team Leader/Supervisor: Mr. Kazuo SUDO, Advisor, Global Environment Department, JICA</p> <p>(2) Weather Analysis Evaluation: Mr. Masashi KUNITSUGU, Numerical Prediction Division, Forecast Department, Japan Meteorological Agency</p> <p>(3) Evaluation Analysis: Ms. Yukiko SUEYOSHI, Global Link Management Inc.</p> <p>(4) Cooperation Evaluation: Mr. Shohei MATSUURA, Disaster Management Division 1, Water Resources and Disaster Management Group, Global Environment Department, JICA</p>	
Period of the evaluation	September 5 to 25, 2008	Type of evaluation: Terminal evaluation
<b>III. Outline of the evaluation results (A: very good; B: good; C: partially good but has problems; D: bad)</b>		
<p><b>3-1 Confirmation of the achievements</b></p> <p><b>(Degree of achievement of the project goal)</b> Evaluation result (B): Based on the results of this evaluation study, we made the following judgments: (1) The skills transferred by the Japanese experts have been used effectively for NAMHEM's daily work; (2) Because the skills acquired by the counterparts (CPs) were disseminated among young engineers, the project goal to improve the meteorological service through the development of human resources of NAMHEM is being realized.</p> <p><b>(Degree of achievement of Output 1) Numerical forecasting</b> Evaluation result (A): Output 1 aims to develop human resources to provide more accurate forecasting services based on numerical forecasting, using the computer system introduced according to the grant aid project called the "Project for Improvement of the Meteorological Information Network," which Japan carried out in 2003. As a result of this evaluation study, it was confirmed that the CPs have acquired the knowledge and skills necessary for the development of a regional numerical forecasting model through the lectures and practice conducted by the Japanese experts and reached a level that is sufficient for them to be applied in everyday operations. The achievements of this Project can be seen from some factual results: for example, the implementation of this Project has resulted in an improvement in the accuracy of forecasting in the Mongolian region and extension of the forecasting period from three days to five days.</p>		

**(Degree of achievement of Output 2) Climate change prediction**

Evaluation result (B): For the purpose of supporting the implementation of NAMHEM's "Meteorological Environment Sector Development Program until 2015," Output 2 aims to improve the accuracy of the climate change prediction model and disclose information through the development of human resources engaged in the climate change prediction service (Output 2 is planned to be realized by the end of this Project). Because a CP went abroad to study during the project period, but no new CP was assigned, the target number of human resources to be developed was not achieved. However, it is confirmed that the official studying abroad will be engaged in the climate change prediction service after returning to Mongolia. Moreover, because the officials whose capability in the sector was improved through this Project are positive about the training of young officials, the achievement of further outputs can be expected in the future.

**(Degree of achievement of Output 3) Weather forecasting**

Evaluation result (B): Although NAMHEM has improved the information processing system and accumulated weather data through the development of weather forecasting equipment provided by Japan's grant aid and other sources, it is necessary to train engineers who can effectively use the equipment and data. This output aims to establish a guidance working group centering on the CPs and to develop human resources for the preparation of guidance based on the results of numerical forecasting. Because no new CP was added in spite of a CP studying abroad or retirement during the project period, the target number of human resources was not achieved. On the other hand, because the officials whose capability in the sector was improved through this Project have begun to train young engineers on their own, the achievement of further outputs can be expected in the future.

**(Degree of achievement of Output 4) Early warning system for droughts and *zud***

Evaluation result (B): This output aims to improve the existing weather observation system for agriculture and livestock farming and develop human resources engaged in the creation of an early warning system for droughts and *zud* based on the observation data. The implementation of this Project resulted in the subdivision of the scale of the map for grass volume and its level from the county (sum) to the village (bag) level and the preparation of guidelines that specify the alert point necessary for the issuance of a warning for droughts or *zud*. However, the use of the guidelines is limited.

**(Degree of achievement of Output 5) Popularization of the weather service**

Evaluation result (A): This output aims to assess the needs of weather information users and increase their understanding of weather information through seminars and workshops for government offices related to disaster prevention and the pilot provincial agencies related to disaster prevention and residents. The implementation of this activity resulted in the deepening of the knowledge of weather information users and an increase in the motivation of information providers of the weather forecasting services through their dialogue with the users. Moreover, this activity also contributed to the promotion of cooperative relationships with NAMHEM and related government offices, especially NEMA.

**(Degree of achievement of Output 6) Management and maintenance of the weather observing and forecasting system**

Evaluation result (A): This output aims to promote the sustainable use and maintenance of the Doppler weather radar and the computer network that Japan gave through grant aid and to develop the human resources necessary for the management and maintenance of the

equipment and the operation of the systems. As a result of interviews with the Japanese experts and CPs, it was confirmed that skills in the management and maintenance of the weather observing and forecasting system had reached a sufficient level at the time of the evaluation. On the other hand, although the equipment procured with grant aid is in operation, it has become decrepit and the manufacturers have already discontinued the manufacture of spare parts.

### **(Degree of achievement of Output 7) Monitoring of the yellow sand phenomenon**

Evaluation result (A): This output was added in March 2005 after the beginning of this Project and aims to provide the equipment necessary for the creation of a network for monitoring the yellow sand phenomenon and to develop the human resources necessary for this monitoring. The data sent regularly from the four observatories in which equipment for observing the yellow sand phenomenon was installed were effectively used by the CPs and Japanese experts to provide the information necessary for analyzing the situation of the yellow sand phenomenon and the conditions related to air pollution.

## **3-2 Summary of the evaluation results (A: very good; B: good; C: partially good but has problems; D: bad)**

### **(1) Relevance**

Evaluation result (A): NAMHEM's "Meteorological Environment Sector Development Program until 2015" specifies that NAMHEM will aim to improve its meteorological service through the development of human resources, the modernization of meteorological equipment, the creation of a meteorological network, etc. by 2015. Moreover, in relation to environmental conservation, one of the priority sectors, Japan's ODA policy called "2004 Country Assistance Program for Mongolia" specifies comprehensive support for meteorological and environmental monitoring and the establishment of a natural environment information system. There is therefore consistency with this Project. Because NAMHEM is a government agency that has unified control of the provision of weather information, improvement in the knowledge and skills of NAMHEM officials is essential for improving the meteorological service. Therefore, it can be considered that the selection of the target group and the executing agency was appropriate.

### **(2) Effectiveness**

Evaluation result (B): It has been confirmed that the implementation of this Project resulted in an improvement in the meteorological knowledge and skills of the CP and that the development of human resources resulted in an improvement in the accuracy of weather information. However, the indicator for measuring the degree of achievement (the number of trained persons) has still not been fulfilled completely. Because the knowledge and skills essential for improving NAMHEM's meteorological service have already been transferred, it can be considered that the outputs planned for this Project have directly contributed to the achievement of the project goals. Output 5 aims to carry out awareness raising activities among the administrative agencies and the nomads that use weather information and to promote the improvement of the quality of a meteorological service that reflects the needs of the users.

### **(3) Efficiency**

Evaluation result (B): It was confirmed that the inputs from the Japanese side were carried out almost according to plan in terms of quantity, quality and timing and that the inputs were fully used in achieving the project goal. These inputs have already been effectively used for the daily work of the CPs without causing any limitations on project activities. The equipment provided by the Japanese side was also used appropriately and engineers required for its maintenance have also been assigned appropriately. It can be considered that, to improve the efficiency of this Project, it was necessary to confirm the status of progress based on the PDM more frequently. The Mongolian side also appropriately provided the personnel and facilities required for the implementation of this Project. Although some activities were delayed due to one CP studying abroad and other personnel changes, all the activities are expected to eventually be implemented.

#### **(4) Impact**

Evaluation result (B): To achieve the overall goal, it is essential to strengthen the cooperative relationship between NAMHEM and the related organizations and use weather information for the preparation of policies related to the management of natural disasters. At present, however, this seems to be still at an early stage where NAMHEM shares with related organizations weather information whose accuracy level has been increased than before. As positive impacts, the following cases were reported: the CPs used the monitoring data of the yellow sand phenomenon, one of the achievements of this Project, for improving research and studies and expanding the joint research network with other organizations and local workshop participants have changed their behavior in accordance with the weather information.

#### **(5) Sustainability**

Evaluation result (A): With regard to the political aspects, because NAMHEM is planning to develop human resources in the weather sector, improve weather information and create a nationwide weather network as specified in the “Meteorological Environment Sector Development Program until 2015,” political support has been secured to continue the achievements of this Project. With regard to the organizational and financial aspects, given that 1) NAMHEM has a high sense of responsibility for and ownership of the weather sector in Mongolia as the government agency that controls the Ministry of Nature and Environment’s provision of weather information and that 2) NAMHEM’s annual budget has been on an upward trend because of its importance in the national strategy for the weather sector, the sustainability can be said to be high. Moreover, because the CPs have already begun to use new the skills and knowledge acquired through this Project for their daily work and have been training engineers in their department, the sustainability was also judged to be high from the viewpoint of skills and knowledge.

### **3-3 Factors for the emergence of the effects**

The first factor for the emergence of the effects is that the foundations for weather observation service on the part of the CPs were established by the dispatch of experts and the provision of grant aid by Japan. Moreover, according to the results of interviews with the CPs, it was pointed out that the knowledge and skills transferred from the Japanese experts were directly connected to their daily work and fulfilled the Mongolian side’s technical needs. This increased the ownership by NAMHEM’s CPs and engineers of this Project and their motivation to participate in the project activities, resulting in smooth progress in various activities. The other factor regarding the increase in ownership by the CPs was the direct

dialogue with the users in local workshops. It was reported that the participation in the workshops served as an opportunity to promote the provision of an easy-to-use meteorological service.

### **3-4 Problems and related factors**

One of the problems with this Project is that, because some of the CPs at the beginning of this Project went abroad to study or left their jobs, but were not replaced, the target number of the CPs was not attained. On the other hand, because the officials trained under this Project have been eager to train young officials, it can be expected that the necessary number of trained engineers will be achieved.

### **3-5 Conclusions**

To realize the project goal of the “provision of more accurate weather information through the development of human resources,” JICA developed human resources for NAMHEM to contribute to the improvement of the meteorological service. At the time of this evaluation, some activities are in progress concerning the seven outputs for the achievement of the project goal. The CPs have acquired the capabilities to continue the activities independently, use them for their daily work and disseminate the achievements. Because of this, the equipment provided under this Project has also been used effectively and a system for maintaining the equipment has been established. Therefore, the sustainability of this Project was judged to be very high. To expand the achievements of this Project in the future, it is desirable for NAMHEM to strengthen its cooperation with related government offices and agencies and clarify the role of the weather sector in the management of natural disasters.

### **3-6 Recommendations**

The recommendations to NAMHEM in the terminal evaluation can be summarized as follows:

- 1) NAMHEM should continue to verify the numerical forecasting model and use the model for the service.
- 2) NAMHEM should widely popularize the fruits of this Project related to droughts, *zud*, climate change, etc., among the general public.
- 3) NAMHEM should establish an early warning system for droughts and *zud*, create an in-house system for disseminating information among the general public without fail and provide information to the Ministry of Nature, Environment and Tourism (MNET), the Ministry of Food and Agriculture (MFA), the National Emergency Management Agency (NEMA) and other government offices.
- 4) NAMHEM should continue to hold the training seminars that were given in the three pilot provinces and expand the target areas.
- 5) NAMHEM should secure the budget for the above-described activities and the continuous maintenance of the provided equipment even after the end of this Project.

### **3-7 Lessons**

- 1) **Lessons concerning the technical transfer:** If, as with the CPs in this Project, personnel have substantial experience in the meteorological service, the transfer of advanced skills and knowledge by the Japanese experts can be carried out more effectively. Moreover, if leading persons are appointed as the CPs, the transfer of

technical skills to young engineers and the dissemination of knowledge among them will be further promoted. As a result, this Project is highly likely to become a factor in facilitating independent development.

- 2) **Lessons concerning the monitoring system:** Technical transfer, which centers on the dispatch of short-term experts, may face difficulties in continuously carrying out monitoring activities to check the progress of the project. Therefore, it is important for the CPs and Japanese experts to share information on the progress of the project and positively promote consultations with each other about problems during the implementation of the project in order to improve the efficiency of the project.